

This lesson is part of a larger, comprehensive school garden guide called **Minnesota School Gardens: A Guide to Gardening and Plant Science** developed by Minnesota Agriculture in the Classroom in 2013. The entire guide is available at www.mda.state.mn.us/maitc.



Grade

Middle School

Materials/Preparation

- ☐ Teacher Material A – Vocabulary Organizer – one per teacher
- ☐ Teacher Material B – Soil Test Results – one per teacher
- ☐ Handout A – New Terms – one per student
- ☐ Assessment A – Soil Testing 1, 2, 3 – one per student
- ☐ Pictures or samples of plants with nutrient deficiencies
- ☐ Soil testing kit available from a garden center or the LaMotte Top Soil Tour Kit from Carolina Biological Supply Company
- ☐ Soil sample from school garden plot or container
- ☐ Soil samples from other locations; students may bring samples from home

Get a soil testing kit before the lessons. If you have the LaMotte Top Soil Tour Kit, read through the suggested units provided. Duplicate any handouts, procedures, or background information students may need to complete the experiences. Prior to the lesson, instruct students to collect soil samples from a lawn near their home.

Soil Testing 1, 2, 3

Minnesota K-12 Academic Standards

Science	7.4.2.2	The flow of energy and the recycling of matter are essential to a stable ecosystem.
Language Arts	9.5.4.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).

Summary/Overview

Students learn terms associated with soil science. Using soil samples from several locations, students test for nutrient levels. A soil testing kit is required for this lesson.

Garden Connection

Students collect soil samples and analyze them to determine the soil composition.

Background Information

We live on soil. Fibers for our clothes are collected from crops grown in various types of soils. The basis of the USDA MyPlate nutritional guide is supported by soil. Soil also provides a home for microorganisms and animals that replenish the soil with nutrients that are required for everything mentioned above.

Plants in soil need various amounts of each element to be healthy. The concentration of an element in the soil can be directly related to how well the plant produces. The element must be present in an optimum dose, not too much or too little. In the agricultural industry, managing proper soil fertility is critical for a good harvest. Rotating crops is important, as nutrients need to be replenished in the soil. Planting the same crop year after year in the same soil depletes the soil of certain nutrients. Producers

Fun Fact

Sweet corn comes from the maize family. Its scientific name is *Zea mays*. Other types of maize, or corn, are used as flour to make some types of bread and breakfast cereals. Popcorn is also a type of maize.



test their soil to determine levels of nutrients. This information helps them determine the best way to manage their soil.

Objectives

- Organize soil testing vocabulary terms according to theme.
- Conduct a soil test.
- Compare nutrient levels in different soil samples.

Procedure

Interest Approach

Display pictures or samples of plants with nutrient deficiencies. (Find images of nutrient deficient plants on Google Images.) Ask students if they know what is wrong with the plants. Explain that just like us, plants need certain nutrients for healthy growth. Some nutrients are needed in larger amounts than others. Even though some nutrients are needed in small quantities, all essential nutrients are important for healthy plants.

Next ask students where plants obtain the nutrients they need. Discuss how plants absorb nutrients from the soil. If the soil is lacking in required nutrients, plant health suffers. Soil tests reveal nutrient levels and assist gardeners in applying correct amounts and types of nutrients.

Summary of Content and Teaching Strategies

Discuss the terms on Handout A. Show Teacher Material A and lead students through the vocabulary organizer as described. When students are finished they compare with other groups or the whole class.

Conduct activities and labs selected from the LaMotte Top Soil Tour Kit. Students record their test results. They also write a recommendation for the soil. For example: add nitrogen and decrease potassium.

Review/Summary

When students have completed their soil tests, have them write their results on Teacher Material B. Discuss the difference between samples.

Modifications/Extensions

Have students select a career related to soil science. They research the career and write a report including basic information such as general work activities, skills and abilities, working conditions, preparation, wages, and employment outlook. Include a paragraph on how the career relates to soil science.



Sources/Credits

Adapted from *Technology, Life and Careers Agricultural Science and Technology Instructional Guide*, project of the Utah State Office of Education. Project Director Richard M Joerger, PhD., developed and written by Brenda Mager and Kari Osterhout, 1995.

Vocabulary organizer

1. Break into groups of two or three students.
2. Cut the new terms found on Handout A into strips.
3. Look for common themes in the terms and organize them in groups.
4. Create descriptive titles for the themes and list across the top of a piece of paper. (It may be helpful to turn the paper to the landscape orientation.)
5. Terms may be used in more than one theme, while others may not fit into a theme.

Example Answers

Theme: It's Alive

Terms: decomposers, legumes, and microorganisms

Theme: pH

Terms: pH, acidic soil, alkaline soil

Theme: Elements

Terms: micronutrient, macronutrient

Soil Test Results

Student(s) Name(s)	Soil Sample (location of sample)	pH Level (#, basic, acidic)	Nitrogen Level (low, medium, high)	Potassium Level (low, medium, high)	Phosphorus Level (low, medium, high)



New Terms

pH: a measure of how acidic or basic things are.

Acidic soil: soil with a pH value of less than 7.0.

Alkaline soil: soil having a pH greater than 7.0.

Compost: a mixture of dead and decaying organic matter-leaves, garbage, animals with soil. Bacteria in the soil break down the organic matter into soil and nutrients.

Decomposers: animals and microorganisms that help break down organic matter in the soil: worms, bacteria, fungus, etc.

Extraction: separation of plant nutrients from soil samples by dissolving them and filtering out soil particles.

Filtrate: the liquid solution that passes through a filter.

Humus: very decomposed organic matter; contains mainly carbon, nitrogen, phosphorus, and sulfur.

Legumes: a group of plants that have a unique capability of converting nitrogen in the atmosphere into a form that can be used by the plant. Alfalfa, clover, peanuts, and soybeans are examples of legumes.

Macronutrients: an essential chemical element needed in large amounts for the healthy growth of plants – Nitrogen (N), Phosphorus (P), and Potassium (K) are considered the primary macronutrients

Micronutrients: an essential chemical element needed only in extremely small amounts for the healthy growth of plants.

Microorganisms: living organisms that are so small individually they can only be seen through a microscope.

Organic matter: remains of decomposed plants and animals.

Soil: the top layer of the Earth's surface; a mixture of mineral, organic matter, and living things in which plants grow.

Topsoil: the upper layer of soil that contains the greatest amount of decomposed organic matter and plant nutrients.

Name _____



Soil Testing 1, 2, 3

Matching

Place the letter of the correct vocabulary word the corresponding definition.

- | | |
|--------------------------|---|
| A. pH | 1. _____ an essential chemical element needed in large amounts for the healthy growth of plants – Nitrogen (N), Phosphorus (P), and Potassium (K) are considered the primary macro elements. |
| B. Acidic soil | |
| C. Alkaline soil | 2. _____ a measure of how acidic or basic things are. |
| D. Macronutrient | |
| E. Micronutrient | 3. _____ an essential chemical element needed only in extremely small amounts for the healthy growth of plants. |
| F. Organic matter | |
| G. Soil | 4. _____ the upper layer of soil; contains the greatest amount of decomposed organic matter and plant nutrients. |
| H. Topsoil | 5. _____ soil with a pH value of less than 7.0. |
| | 6. _____ the top layer of the earth's surface; a mixture of mineral, organic matter, and living things in which plants grow. |
| | 7. _____ any soil having a pH greater than 7.0. |
| | 8. _____ remains of decomposed plants and animals. |